Notice No.6

Rules and Regulations for the Classification of Naval Ships, January 2019

The status of this Rule set is amended as shown and is now to be read in conjunction with this and prior Notices. Any corrigenda included in the Notice are effective immediately.

Please note that corrigenda amends to paragraphs, Tables and Figures are not shown in their entirety.

Issue date: November 2019

Amendments to	**Effective date**	**IACS/IMO implementation (if applicable)**
Volume 2, Part 2, Chapter 1, Sections 2 & 7	1 January 2020	1 January 2020
Volume 2, Part 3, Chapter 2, Section 4	1 January 2020	1 January 2020
Volume 2, Part 7, Chapter 2, Section 11	1 January 2020	N/A
Volume 2, Part 9, Chapter 1, Section 1	1 January 2020	N/A
Volume 2, Part 9, Chapter 3, Section 6	1 January 2020	N/A

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Volume 2, Part 2, Chapter 1
Reciprocating Internal Combustion Engines

■ *Section 2*
Materials and components

2.2 Testing and inspection

2.2.1 Materials and components for engines are to be manufactured, tested and documented in accordance with *Table 1.2.1 Summary of testing and associated documentation for engine components* under a quality control system that is suitable for the actual engine types to be certified by LR. *See also Vol 2, Pt 2, Ch 1, 2.2 Testing and inspection 2.2.4* and the applicable requirements specified in the *Rules for the Manufacture, Testing and Certification of Materials, July 2019*.

2.2.3 The testing and inspection in *Table 1.2.1 Summary of testing and associated documentation for engine components* is to be documented by the manufacturer (e.g. manufacturer certified materials testing or manufacturer issued NDT report as applicable), except where LR intervention is explicitly required, in which case an LR Component Certificate is to be issued which confirms conformity with the Rule requirements, with tests carried out on either the finished component itself or on samples taken from earlier stages in the production of the component, as applicable.

2.2.4 ~~All material~~ Where an LR material certificate is specified for components listed in *Table 1.2.1 Summary of testing and associated documentation for engine components*, the material is to be from an LR approved manufacturer, and manufactured within the scope of approval of that manufacturer, except where explicitly stated otherwise in other Parts and Chapters of the Rules.

2.2.6 Where *Table 1.2.1 Summary of testing and associated documentation for engine components* states that a test report is required, this is to be issued by the manufacturer and provided for review by the Surveyor. The report is to identify the samples from the current production batch that have been tested and inspected to confirm that the component complies with all applicable requirements.

2.2.7 Where a manufacturer's document (test certificate or NDT report) is required in *Table 1.2.1 Summary of testing and associated documentation for engine components*, this is to be issued by the manufacturer and provided for review by the Surveyor. The document is to comply with the requirements of the *Rules for the Manufacture, Testing and Certification of Materials, July 2019, Ch 1, 3.1 General 3.1.3(c)* or *Ch 1, 5.5 Non-destructive examination reports 5.5.1* as applicable and is to identify the tests and inspections that have been carried out on the finished component itself or, where applicable, on samples taken from earlier stages in the production of the component.

(Part only shown)

Table 1.2.1 Summary of testing and associated documentation for engine components

Part	**Material properties *see* Note 2**	**Non-destructive examination**	**Hydraulic testing *see* Note 4**	**Dimensional inspection *see* Note 3**	**Visual inspection**	**Applicable to engines**	**Final document to be issued**
Cylinder block (grey cast iron or spheroidal graphite cast iron)	-	-	W (P) *see* Note 6	-	-	~~Crosshead~~ >400kW/cylinder	W Hydraulic Test Certificate
Piston rod	LR(C + M)	W (UT + CD)	-	-	LR(V) (Random)	Crosshead B>400mm	LR Component Certificate
High pressure fuel injection system – ~~valve and~~ pump body (pressure side) *see* Notes 10 and 11	~~/~~ W(C + M)	-	W (Lesser of P or *p*+30 MPa	-	-	B>300mm	W Material Properties Certificate W Hydraulic Test Certificate or Test Report. *See* Note 14
			TR (Lesser of P or *p*+30 MPa)			B≤300mm	
High pressure fuel injection system – valves *see* Note 10	-	-	W (Lesser of P or *p*+30 MPa	-	-	B>300mm	W Hydraulic Test Certificate or Test Report. *See* Note 14
			TR (Lesser of P or *p*+30 MPa)			B≤300mm	
High pressure fuel injection pipes including common rail *see* Note 10	W(C + M)	-	W (Lesser of P or *p*+30 MPa)	-	-	B>300mm	W Material Properties Certificate W Hydraulic Test Certificate or Test Report. *See* Note 14
			TR (Lesser of P or *p*+30 MPa)			B≤300mm	
High pressure common servo oil system	W(C + M)	-	W (Lesser of P or *p*+30 MPa)	-	-	B>300mm	W Material Properties

			TR (Lesser of P or P+30 MPa)			B≤300mm	Certificate W Hydraulic Test Certificate or Test Report. *See* Note 14
Coolers, both sides *see* Note 12	W(C + M)	-	W (P)	-	-	B>300mm	W Material Properties Certificate W Hydraulic Test Certificate. *See* Note 14
Accumulator ~~of common rail fuel or servo oil system~~	W(C + M)	-	W (Lesser of P or p+30 MPa)	-	-	Accumulators with a capacity >0,5l	W Material Properties Certificate W Hydraulic Test Certificate. *See* Note 14
Piping, pumps, actuators, etc., for hydraulic drive of valves, if applicable	W(C + M)	-	W (P)	-	-	>800kW/cylinder	W Material Properties Certificate W Hydraulic Test Certificate. *See* Note 14
Engine-driven pumps (oil, water, fuel, bilge) excluding those listed separately above	-	-	W (P)	-	-	>800kW/cylinder	W Hydraulic Test Certificate. *See* Note 14

SYMBOLS:

B = Bore dimension, refers to engine cylinder bores
C = Chemical composition analysis
M = Mechanical property analysis
UT = Ultrasonic testing (*see* Note 1)
CD = Crack detection by MPI or DPT (*see* Note 7)
W ( ) = Test/inspection to be certified by manufacturer

p = Maximum working pressure of item concerned
P = Pressure test at 1,5p
V = Visual examination of accessible surfaces
LR( ) = Test/inspection to be certified by LR
TR[ ] = Test report required for process in brackets (*see ~~Pt 5, Ch 2,~~Vol 2, Pt 2, Ch 1, 2.2 Testing and inspection 2.2.6*)

Note 14. Material certification requirements for pumps and piping components are dependent on the operating pressure and temperature. Requirements given in this table apply except where alternative requirements are explicitly given elsewhere in the Rules. *See Vol 2, Pt 7, Ch 1, 4.1 Metallic materials.*

■ *Section 7*
Control and monitoring of main, auxiliary and emergency engines

7.1 General

(Part only shown)

7.1.2 Oil mist detection or engine bearing temperature monitors (or equivalent device) fitted as required by *Vol 2, Pt 2, Ch 1, 10.8 Oil mist detection 10.8.1* are to operate as follows:

(e) Where engine bearing temperature monitors or equivalent devices are provided for the prevention of the build-up of oil mist that may lead to a potentially explosive condition within the crankcase, details are to be submitted for consideration. The submission is to demonstrate that the arrangements are equivalent to those provided by oil mist detection, *see Vol 2, Pt 2, Ch 1, 10.8 Oil mist detection 10.8.15*.

Where required, for each trunk piston engine, one oil mist detector (or engine bearing temperature monitoring system or equivalent device) having two independent outputs for initiating the alarm and shutdown would satisfy the requirement for independence between alarm and shutdown systems.

7.2 Main engine governors

7.2.3 When electronic speed governors of main internal combustion engines form part of a remote control system, they are to comply with the following conditions:

(a) If lack of power to the governor may cause changes in the present speed and direction of thrust of the propeller, which consequently compromise safe operation of the vessel, then backup power supply is to be provided.

(b) Local control of the engines is always to be possible. A means to effect safe transfer of control to the local control position and then control the engine is to be available in all normal and reasonably foreseeable abnormal conditions.

(c) In addition, electronic speed governors and their actuators are to be type approved in accordance with LR's Type Approval System Test Specification Number 1.

7.3 Auxiliary and emergency engine governors

Existing paragraphs 7.3.1 to 7.3.5 have been deleted and replaced with below.

7.3.1 Prime movers for driving generators of the main and emergency sources of electrical power are to be fitted with a speed governor which will prevent transient frequency variations in the electrical network in excess of ±10 per cent of the rated frequency, with a recovery time to steady state conditions not exceeding 5 seconds, when the maximum electrical step load is switched on or off.

7.3.2 In the case when a step load equivalent to the rated output of a generator is switched off, a transient speed variation in excess of 10 per cent of the rated speed may be acceptable, provided that this does not cause the intervention of the overspeed device as required by *Vol 2, Pt 2, Ch 1, 7.4 Overspeed protective devices*.

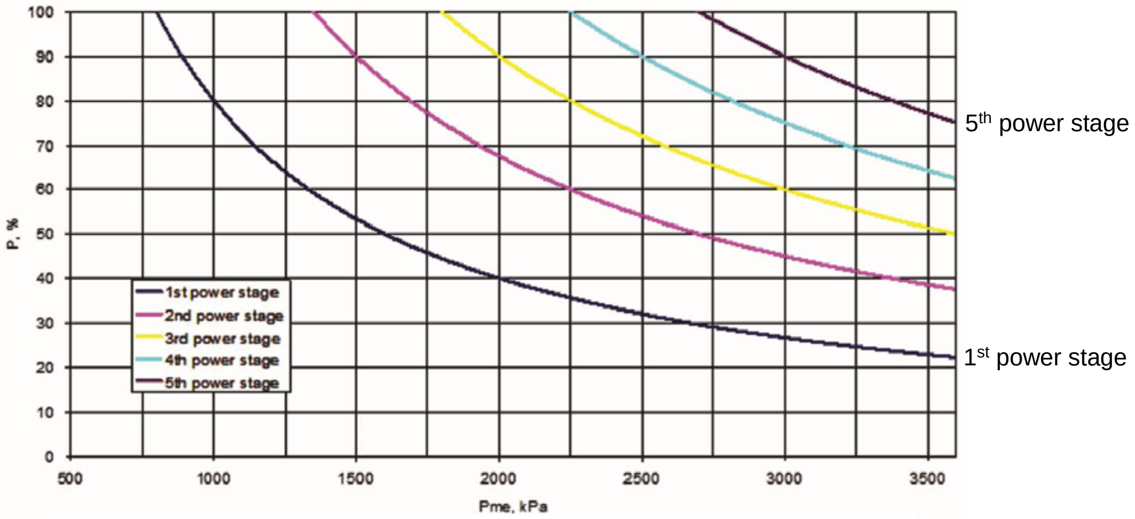
7.3.3 At all loads between no load and rated power, the permanent speed variation should not be more than ±5 per cent of the rated speed.

7.3.4 Prime movers are to be selected in such a way that they will meet the load demand within the ship's power distribution system. Application of electrical load should be possible with two load steps and must be such that prime movers, running at no load, can suddenly be loaded to 50 per cent of the rated power of the generator followed by the remaining 50 per cent after an interval sufficient to restore the speed to steady state. Steady state conditions should be achieved in not more than 5 seconds. Steady state conditions are those at which the envelope of speed variation does not exceed +1 per cent of the declared speed at the new power.

7.3.5 Application of electrical load in more than two load steps can only be permitted if the conditions within the ship's power distribution system permit the use of such prime movers which can only be loaded in more than two load steps (*see Figure 1.7.1 Reference values for maximum possible sudden power increase (four-stroke engines)*) and provided that this is already allowed for at the design stage. This is to be verified in the form of system specifications to be approved and to be demonstrated at ship's trials. In this case, due consideration is to be given to:

(a) The power required for the electrical equipment to be automatically switched on after blackout and to the sequence in which it is connected.

(b) Where generators are to be operated in parallel and where the power has to be transferred from one generator to another in the event of any one generator being switched off.



P_{me} : mean effective pressure at declared power

P : power increase referred to declared power at site conditions

Figure 1.7.1 Reference values for maximum possible sudden power increase (four-stroke engines)

7.3.6 Emergency generator sets are to comply with the requirements of *Vol 2, Pt 2, Ch 1, 7.3 Auxiliary and emergency engine governors 7.3.1* to *Vol 2, Pt 2, Ch 1, 7.3 Auxiliary and emergency engine governors 7.3.3* even when:

(a) their total consumer load is applied suddenly; or

(b) their total consumer load is applied in steps, subject to:
  - the total load being supplied within 45 seconds of power failure on the main switchboard;
  - the maximum step load being declared and demonstrated;
  - the power distribution system being designed such that the declared maximum step loading is not exceeded; and
  - the compliance of time delays and loading sequence with the above being demonstrated at ship's trials.

7.3.7 For a.c. generating sets operating in parallel, the governing characteristics of the prime movers shall be such that within the limits of 20 per cent and 100 per cent total load, the load on any generating set will not normally differ from its proportionate share of the total load by more than 15 per cent of the rated power of the largest machine, or 25 per cent of the rated power of the individual machine in question, whichever is the less. For an a.c. generating set intended to operate in parallel, facilities are to be provided to adjust the governor sufficiently finely to permit an adjustment of load not exceeding 5 per cent of the rated load at normal frequency.

7.3.8 For generator set voltage control requirements *see Vol 2, Pt 9, Ch 2, 6.4 Generator control*.

7.3.9 For quality of power supplies (QPS) requirements *see Vol 2, Pt 9, Ch 1, 2.1 Quality of power supplies (QPS).*

7.7 Engines for propulsion purposes

(Part only shown)

Table 1.7.1 Engines for propulsion purposes: Alarms and slow-downs

Item	**Alarm**	**Note**
~~Oil mist concentration in crankcase or bearing temperature~~ Activation of oil mist detection arrangements (or activation of the temperature monitoring systems or equivalent devices of: - the engine main, crank and crosshead bearing oil outlet; or - the engine main, crank and crosshead bearing)	High	~~*See Vol 2, Pt 2, Ch 1, 7.1 General 7.1.2.* Automatic slow-down of crosshead engines, for trunk piston engines *see Table 1.7.2 Engines for propulsion purposes: Automatic shutdowns.*~~ For crosshead engines, automatic slow-down. For trunk-piston engines, *see Table 1.7.2 Engines for propulsion purposes: Automatic shutdowns. See also Vol 2, Pt 2, Ch 1, 7.1 General 7.1.2*.

(Part only shown)

Table 1.7.2 Engines for propulsion purposes: Automatic shutdowns

Item	**Alarm**	**Note**
~~Oil mist concentration in crankcase or bearing temperature~~ Activation of oil mist detection arrangements (or activation of the temperature monitoring systems or equivalent devices of: - the engine main and crank bearing oil outlet; or - the engine main and crank bearing)	High	~~*See* Vol 2, *Pt 2, Ch 1, 7.1 General 7.1.2* Automatic shutdown of trunk piston engines, for crosshead engines *see Table 1.7.1 Engines for propulsion purposes: Alarms and slow-downs*~~ For trunk piston engines, automatic shutdown. For crosshead engines, *see Table 1.7.1 Engines for propulsion purposes: Alarms and slow-downs. See also Vol 2, Pt 2, Ch 1, 7.1 General 7.1.2*.

7.8 Auxiliary engines

(Part only shown)

Table 1.7.3 Auxiliary engines: Alarms and safeguards

Item	**Alarm**	**Note**
~~Oil mist concentration in crankcase or bearing temperature~~ Activation of oil mist detection arrangements (or activation of the temperature monitoring systems or equivalent devices of: - the engine main and crank bearing oil outlet; or - the engine main and crank bearing)	High	Automatic shutdown of engine, *see also Vol 2, Pt 2, Ch 1, 7.1 General 7.1.2*

7.9 Emergency engines

(Part only shown)

Table 1.7.4 Emergency engines: Alarms and safeguards

Item	**Alarm for engine power <220 kW**	**Alarm for engine power ≥220 kW**	**Note**
~~Oil mist concentration in crankcase~~ Activation of oil mist detection arrangements (or activation of the temperature monitoring systems or equivalent devices of: - the engine main and crank bearing oil outlet; or - the engine main and crank bearing)	—	High	*See* Note
Note For engines having a power of more than 2250 kW or a cylinder bore of more than 300 mm.			

Volume 2, Part 3, Chapter 2
Shafting Systems

■ *Section 4*
Design and construction

4.16 Sternbushes and sterntube arrangements

4.16.3 Synthetic materials for application as water lubricated stern tube bearings are to be approved in accordance with *Rules for the Manufacture, Testing and Certification of Materials, July 2019, Ch 14, 2.13 Sterntube bearings 2.13.1.*

Existing paragraphs 4.16.3 to 4.16.11 have been renumbered 4.16.4 to 4.16.12.

Volume 2, Part 7, Chapter 2
Ship Piping Systems

■ *Section 11*
Ballast System

11.4 Ballast water treatment system installations

11.4.5 All electrical and control equipment forming part of ballast water treatment units shall meet the applicable requirements of *Vol 2, Pt 9 Electrotechnical Systems*. ~~All control equipment forming part of the ballast water treatment units shall meet the applicable requirements of Pt 9~~. ~~Hazardous areas associated with ballast water treatment system installations are to be determined in accordance with the requirements of *Vol 2, Pt 9, Ch 7 Control, Alerts and Safety Systems.*~~

11.4.6 Spaces where ballast water treatment system components are installed are to be assessed to determine their appropriate hazardous area classification in accordance with the requirements of *Vol 2, Pt 9, Ch 5 Hazardous Areas*.

11.4.7 Spaces where ballast water treatment system components are installed are to be assessed for hazards from poisonous, toxic/corrosive, asphyxiant or irritant gases under normal and reasonably foreseeable abnormal conditions.

11.4.8 Where a space containing a ballast water treatment system has been classified as a hazardous area or the presence of other hazardous gases has been identified, then the following applicable requirements are to be applied:

(a) the Gas detection equipment is to be designed, installed and tested in accordance with *IEC 60079-29-2: Explosive atmospheres Part 29-2: Gas detectors – Selection, installation, use and maintenance of detectors for flammable gases and oxygen* and is to be suitable for the gases to be detected;

(b) the requirements of *Vol 2, Pt 9, Ch 5 Hazardous Areas*; and

(c) the requirements of *Vol 2, Pt 9, Ch 11, Gas Detection*.

Volume 2, Part 9, Chapter 1
General Requirements for the Design and Construction of Electrotechnical Systems

■ *Section 1*
General requirements

1.4 Documentation required for design review

1.4.27 For ships with electrical hybrid electrical power systems as detailed in *Vol 3, Pt 1, Ch 6 Hybrid Electrical Power Systems* the following documentation is to be submitted for design review either uniquely or integrated with other submitted information:

Information required for all hybrid electrical power systems:

(a) A functional description of the electrical distribution systems and equipment that details compliance with the performance criteria and system capability and functionality under defined normal and reasonably foreseeable abnormal conditions including:
   i. degraded modes of operation;
   ii. load management and load sharing philosophy;
   iii. earthing philosophy;

    iv. system electrical protection philosophy;
    v. system stability; and
    vi. converter switching actions.
- (b) Definition of system performance targets (*see Vol 3, Pt 1, Ch 6, 4.2 System performance targets*);
- (c) Definition of dependability principles (see *Vol 3, Pt 1, Ch 6, 4.3 Dependability principles*);
- (d) Calculations supporting the size and rating of stores of electrical energy (see *Vol 3, Pt 1, Ch 6, 4.3 Dependability principles 4.3.7*);
- (e) Risk assessment in support of there being no dedicated emergency source of power when this is proposed (see *Vol 3, Pt 1, Ch 6, 4.5 Emergency source of electrical power 4.5.2*);
- (f) Details of any arrangements for external sources of power to charge onboard stores of electrical energy (see *Vol 3, Pt 1, Ch 6, 4.6 External source of electrical power 4.6.3*);
- (g) Voltage rate of rise times for pulse width modulated converters (see *Vol 3, Pt 1, Ch 6, 5.1 Source of electrical power 5.1.6*);
- (h) Risk assessment in support of active fault current limiting devices when this is proposed (see *Vol 3, Pt 1, Ch 6, 5.5 Distribution system 5.5.11*);
- (i) Technical description of energy management functionality (see *Vol 3, Pt 1, Ch 6, 5.6 Energy management 5.6.8*);
- (j) Technical description of arrangements for power quality monitoring (see *Vol 3, Pt 1, Ch 6, 6.2 Power quality and stability 6.2.5*);
- (k) Power system integration procedure (see *Vol 3, Pt 1, Ch 6, 7.1 General*);
- (l) System operational concept (see *Vol 3, Pt 1, Ch 6, 7.2 System operational concept*);
- (m) Technical description of operating modes (see *Vol 3, Pt 1, Ch 6, 7.3 Operating modes*);
- (n) Validated specifications of system components (see *Vol 3, Pt 1, Ch 6, 7.5 System components*);
- (o) Results of energy flow analysis (see *Vol 3, Pt 1, Ch 6, 7.6 Energy flows*);
- (p) Results of power system analysis (see *Vol 3, Pt 1, Ch 6, 7.7 Power system analysis*);
- (q) Definition of safety functions (see *Vol 3, Pt 1, Ch 6, 7.8 Safety functions*);
- (r) System FMEA (see *Vol 3, Pt 1, Ch 6, 7.10 System Failure Modes and Effects Analysis (FMEA)*);
- (s) System operating instructions (see *Vol 3, Pt 1, Ch 6, 7.11 Operating instructions*);
- (t) Description and verification of ship-specific Operator training needs (see *Vol 3, Pt 1, Ch 6, 7.12 Operator training*); and
- (u) Description of through-life system integration roles and responsibilities (see *Vol 3, Pt 1, Ch 6, 7.13 Through-life accountability*).

Additional information required for Hybrid Power (+) notation systems:

- (a) Dependability assessment (see *Vol 3, Pt 1, Ch 6, 4.3 Dependability principles*);
- (b) Technical description of arrangements for automatic earth fault location (*see Vol 3, Pt 1, Ch 6, 5.5 Distribution system 5.5.14*);
- (c) Technical description of arrangements for power quality degradation detection (*see Vol 3, Pt 1, Ch 6, 6.2 Power quality and stability 6.2.5*);
- (d) Technical description of additional energy management functionality (*see Vol 3, Pt 1, Ch 6, 5.6 Energy management 5.6.8*);
- (e) Validation, verification and results of energy flow simulation (*see Vol 3, Pt 1, Ch 6, 7.6 Energy flows 7.6.3*);
- (f) Validation, verification and results of power system simulation (*see Vol 3, Pt 1, Ch 6, 7.7 Power system analysis 7.7.4*);
- (g) Risk assessment study when required (*see Vol 3, Pt 1, Ch 6, 7.9 Risk assessment*); and
- (h) Evidence of ship-specific Operator training verification (*see Vol 3, Pt 1, Ch 6, 7.12 Operator training 7.12.2*).

Volume 2, Part 9, Chapter 3
Electrical Power Distribution and Equipment

■ *Section 6*
Rotating machines – general requirements and motors

6.1 General requirements

6.1.1 ~~Rotating machines are to comply with the relevant part of IEC 60092, or an acceptable and relevant National Standard, and the requirements of this section. In addition, military aspects for shock are to be defined as required by *Vol 2, Pt 1, Ch 3, 4.9 Military requirements*.~~ In addition to the requirements of this Section, rotating machines are to comply with the relevant requirements of the following standards, amended where necessary for ambient temperature, *Table 3.4.1 Ambient operating conditions, Pt 1, Ch 3,4.5 Ambient reference and operating conditions*:
- (a) IEC 60034 *Rotating electrical machines* (all parts); and
- (b) IEC 60092 *Electrical installations in ships* (all parts)*;* or
- (c) an alternative International or National Standard acceptable to LR.

6.1.2 Military aspects for shock are to be defined as required by *Vol 2, Pt 1, Ch 3, 4.9 Military requirements*.

Existing paragraphs 6.1.2 to 6.1.21 have been renumbered 6.1.3 to 6.1.22.

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